

INSIGHTS INTO THE FIRST STARS FROM LOW-FREQUENCY RADIO OBSERVATIONS: THE LUNAR ENVIRONMENT AS AN ASTROPHYSICS PLATFORM. S. R. Furlanetto¹ R. H. Mebane¹, and J. Mirocha² ¹UCLA (sfurlane@astro.ucla.edu), ²McGill University

The formation of the first stars marked a key transition in our Universe’s history, from a simple, dark Universe to one dominated by luminous sources. It also marked the first stages in the formation of “normal” galaxies, which were in place only a few hundred million years later.

While these first stars have not yet been observed directly, their cumulative emission has strong effects on the intergalactic medium – the material between galaxies – that can be observed indirectly through the spin-flip transition of neutral hydrogen. The lunar environment provides an ideal platform for such observations, because it is the quietest and cleanest location in the solar system at the relevant radio frequencies.

The first claimed detection of this spin-flip signal, by the EDGES collaboration in 2018, opens up a new window on the Universe’s “cosmic dawn”. We will describe the measurement’s implications for the formation of the first stars, showing that, if confirmed, the timing of the observed signal fits naturally into our understanding of these first stars, but its amplitude has important implications for their remnant black holes.

Moreover, we will describe how future lunar observations – with both small and large radio telescopes – can probe the details of the first generations of stars, providing a *unique* probe of the earliest generations of structure in our Universe.

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